

URETERAL INJURY

Definition:

- Grade I: hematoma
II: < 50% laceration
III: > 50% laceration
IV: complete transection with < 2cm of devascularization
V: Laceration-avulsion > 2 cm devascularization.

Incidence:

Open Surgical Injury:

- In a review of 13 series:
 - Hysterectomy: 54%
 - colorectal surgery: 14%
 - ovarian tumors: 8%
 - abdominal vascular: 6%.
 - Review of ureteral injury after APR 0.3-5.7% (*St Lezin and Stoller, Urology 1991*).
- In Open cases at least 1/3 of injuries are recognized immediately, whereas the number is less after laparoscopy. (*Grainger, Obst Gyn 1990*) Hence, with laparoscopy patients must be monitored for fever, peritonitis, leukocytosis, prolonged ileus all of which herald the possibility of missed ureteral injury.
- In one series of laparoscopic hysterectomy, 118 patients had injection of indigo carmine dye with subsequent cystoscopy. 4 cases of ureteral ligation were identified and repaired without complications. Making the case for indigo carmine and cysto after all high risk laparoscopic cases.

Diagnosis:

- One shot excretory urography or CT with delayed images.
- CT becoming more common.
- Delayed diagnosis in one report of 35 patients was heralded by anuria-5, urogenital fistula-4, pain/fever-3, urine leak from wound-3, hydronephrosis-1 (*Ghali, J Truama 1999*).

Management:

- Ureteroureterostomy With spatulated, tension free, stented (*Palmer et al, Urology 1999*) watertight anastomosis with non reactive absorbable 5-0, 6-0 monofilament sutures with retroperitoneal drain placement (see images)
 - Presti in 1989 reports a 90% success rate with this in repair in the upper 2/3 of the ureter. Acute complications: abscess, fistula. Chronic: Ureteral stenosis less common.
 - If patient is unstable intraoperatively can tie off ureter with silk ties and drain the kidney percutaneously.
 - Gill in 2001 repaired 4 ureteral injuries laparoscopically, after immediate recognition by gynecology. 8 month follow up show 100% success. Laparoscopic suturing is rate limiting factor.
- Nephrectomy: Poor renal function due to delayed recognition, severe pan ureteral injury (trauma) or persistent fistula despite intervention.

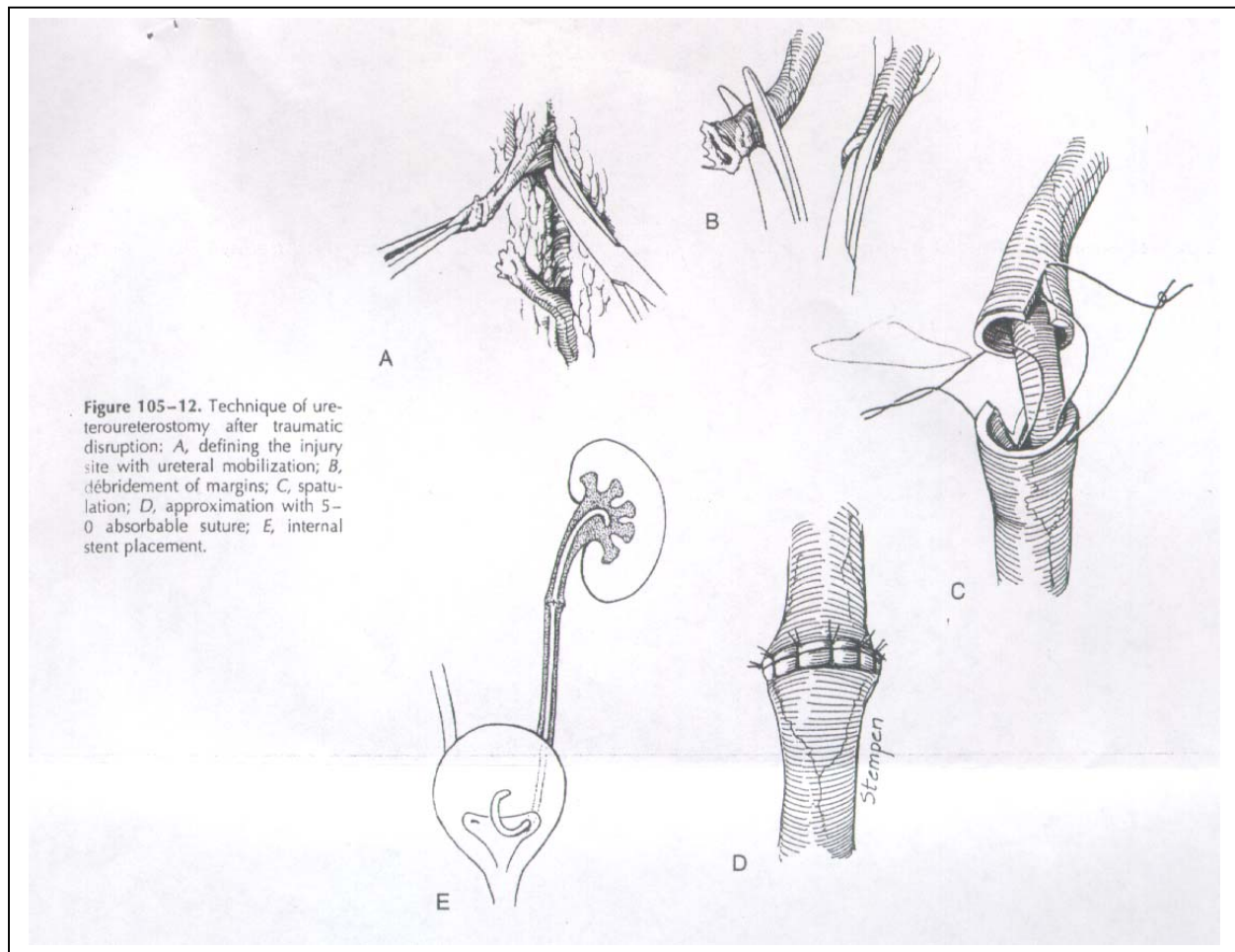
- Injury during vascular graft surgery...post operative urine leak around a prosthetic vascular graft can be fatal. Depends on surgeons leak rate after primary repair which can range from 8-40%.
- Ileal interposition: Injury with large segment of non viable ureter. Creation of a ureteral conduit from ileum: Success is reported at 81% (Boxer 1979)
 - Assimos in 1999 performed 16 ileal interpositions as last resort repair of ureteral injury five of which had injury from colorectal resection. Follow up for 19 months shows 100% success. Although bacteriuria and vesicoileal reflux are common, they have not been associated with deleterious effects on renal function....the procedure...
 “The isolated ileal segment was then passed into the retroperitoneum by way of a "window" created in the colonic mesentery. All ileal ureters were performed in an isoperistaltic fashion. The proximal portion of the isolated bowel segment was anastomosed to the proximal ureter in an end-to-side fashion or to the renal pelvis in an end-to-end fashion. The latter was the preferred technique for stone formers. An interrupted technique using 4-0 monofilament absorbable suture was used for the ureteral-ileal anastomosis, and a running anastomosis using similar suture was used for the pyelo-ileal anastomosis. The ileal-vesical anastomosis was performed with an interrupted or running 3-0 monofilament absorbable suture in a refluxing fashion. The anastomoses were stented with either an 8F ureteral stent or a nasogastric tube.”
- Transureteroureterostomy: Rarely used, but often (97%) successful form of repair involves bringing the injured ureter across the midline and anastomosing it, end-side to the contralateral ureter. Often used with distal injury, when psoas hitch is difficult do to bladder scarring or congenitally small bladder. Not encouraged by many groups because of future access difficulty to that ureter and proximal system.
- Psoas Hitch: Treatment of choice with injury to the lower third of the ureter, preferable over ureteroureterostomy because of tenuous blood supply to the lower third. High success reported >95% (*Campbells Urology, 8th Edition*).
- Delayed Repair: Stenting is possible in only 20-50% of cases do to obstruction and or a gap to long to bridge. If possible, length of stenting has not been adequately studied. Management if stenting is not possible varies from open repair to percutaneous drainage with open repair at a later date.

Prevention:

- Ureteral Stents:
 - Gal et al from North Shore 1998, studied prophylactic ureteral stenting in gynecologic surgery. There were 4 injuries recorded after 3071 cases. 2/2061 had an injury in the group that was not stented and 2/322 pts had an injury in the stented group (p<.094). Surgeries were similar in type and duration. No difference in urinary tract infection was noted. Stents added \$1465 to the cost of the procedure.
 - Both et al in 1994 retrospectively reviewed 561 patients who underwent sigmoid or rectosigmoid colectomy. Stents placed in 90 patients. 4 injuries noted. 2/469 without stents and 2/92 in the stent group, one of which occurred during stenting. 0% anuria.
- Lighted Ureteral Stents:
 - 60 patients underwent laparoscopic colectomy. One ureteral laceration occurred. 4 patients suffered anuria with two requiring hemodialysis. 3 needed bilateral stent placement. Transient hematuria occurred on the average of 2.93 days. (*Silva JSLS 2002*)

Review of the literature on the incidence of ureteral injury during pelvic surgery:

Author	Year	Surgical Specialty	n	Ureteral injuries	
				with catheters (%)	without catheters (%)
Leff <i>et al.</i>	1982	Colorectal	198	4/198 (2.0)	None
Sheikh <i>et al.</i>	1990	Colorectal	59	0/59 (0.0)	None
Kyzer <i>et al.</i>	1994	Colorectal	118	1/118 (0.8)	None
Bothwell <i>et al.</i>	1994	Colorectal	561	2/92 (2.2)	2/469 (0.4)
Present study	1996	Gynecologic	3071	2/469 (0.4)	2/2602 (0.07)
Total			4009	9/938 (0.9)	4/3071 (0.13)



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